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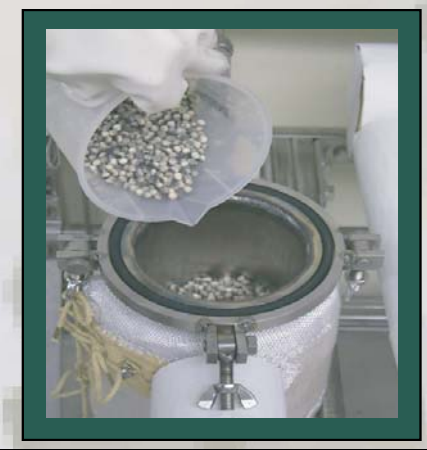
The Pyrolysis with Catalytic Conversion Process

Nuclear Materials Technology Division

The operation and maintenance of processes in the nuclear complex result in the generation of a variety of polymeric materials that are contaminated with actinides. In an attempt to minimize the safety, economic, and political problems associated with the storing and disposing of these materials, Los Alamos National Laboratory has designed a pyrolysis with catalytic conversion process.



The catalytic converter consists of a cylindrical housing containing a bed of 1/4 inch catalyst pellets. The decomposition products enter the converter and are oxidized by the catalyst to CO2 and H2O.

In this process, the polymeric materials are decomposed in a high-temperature chemically inert environment, and the resulting decomposition products are volatilized and removed from the actinides as an off-gas. The remaining material is significantly reduced in both mass and volume, and is in a form suitable for the potential recovery of the actinides. The process also incorporates a catalytic conversion step to oxidize the decomposition products to environmentally benign gases. This step eliminates the formation of any potential waste streams, and effectively mitigates any flammable or combustible hazard that would compromise the safety of the process. The process also has been ergonomically designed and optimized for glovebox operations, and is controlled by a state-of-the-art computer system that facilitates its operation and maintenance.

The pyrolysis with catalytic conversion process (shown above) was developed and implemented at the Los Alamos National Laboratory Plutonium Facility to stabilize polymeric materials contaminated with actinides.

The process has been successfully optimized for the stabilization of cellulose and polycubes (i.e., polystyrene cubes containing oxides of plutonium and uranium). It also has been implemented in a glovebox at the Los Alamos National Laboratory and is now in operation. Work is presently underway to design a more advanced process that can stabilize a more comprehensive array of polymeric materials.

With pyrolysis, 150 grams of cellulose (left) is reduced to 31.3 grams of carbon (right).

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